Together or apart? A behavioural and physiological investigation of sleeping arrangements for twin infants

Dr Helen L. Ball

Senior Lecturer in Anthropology & Director, Parent-Infant Sleep Lab.

Address:

Parent-Infant Sleep Lab & Medical Anthropology Research Group

Department of Anthropology

University of Durham,

43 Old Elvet, Durham, DH1 3HN

Tel: 0191 334 0260 / 0191 334 6207

Fax: 0191 334 6101

Email: H.L.Ball@dur.ac.uk (preferred)

Acknowledgements

This research was funded by project grant 237 from the Foundation for the Study of Infant Deaths. We are grateful for the collaboration of Tamba and local health professionals in the recruitment of families. All of the families who allowed their infants to be monitored, particularly those who travelled long distances with their twins and other offspring to participate in the Sleep Lab trial, deserve special thanks. Emma Heslop, Elaine Hooker, Steve Leech, Tanya Smith, Naz Iqbal, Lian Diong and Catriona McCardle provided research assistance of various kinds.

Abstract

Objective: The pros and cons of co-bedding for healthy twin infants on the post-natal ward and in the home are issues with which midwives need to be familiar, but little objective research has been conducted on which to base policies and recommendations. This two-part study explored the behaviour and physiology of twin infants sleeping separately and together.

Design, setting and participants: In part-one 10 twin infant pairs between 1 and 3 months of age were videoed sleeping together at home in head-to-head and side-by-side configurations. In part-two 14 twin pairs under 3 months of age participated in a 2-condition trial with behavioural and physiological monitoring while sleeping together and apart in the sleep lab.

Findings: In Part One Sleep variables were unaffected by co-bedding configuration. Babies positioned side-by-side were observed to occasionally impinge on, but not obstruct, one another's airways with an arm across the other's face. In Part Two no difference was found in their duration of sleep, frequency of waking, core temperature, or head covering in the two conditions; co-bedded twins exhibited more synchronous sleep states.

Conclusions: The co-bedding of term twin infants less than 3 months of age does not appear to be associated with the negative attributes that concern some parents, and there may be advantages in terms of sleep synchrony and ease of care. These results can be used by health professionals in formulating guidance for parents of twins.

Introduction

Parents may seek the guidance of health professionals regarding the pros and cons of sleeping arrangements for healthy twin infants, but there are currently few published data on which advice can be based (Holditch-Davis et al. 1999). With the increasing trend in multiple births (Beck 2002; MBF 2005) the demand for information concerning the care of multiples will continue to increase (Bowers 1998). We have previously ascertained that both co-bedding and separate sleeping are commonly used arrangements for twin infants up to three months of age, with separate sleeping gaining parental popularity as infants grow; in the absence of guidance from health professionals parents of twins advance various explanations for their practices (Ball 2006). Concerns that babies would disturb one another's sleep, could overheat, or squash each other if co-bedded caused some parents to sleep their twins separately. Parents favouring co-bedding believed their infants preferred being together, slept better, had more synchronous sleep, and proved easier to care for (Ball 2006). Despite an extensive review of nursing and paediatric literature (via bibliographic databases including Medline, CINAHL, EMBASE, Web of Science) no studies could be found to provide empirical support or refutation for any of these beliefs, although anecdotal evidence and theoretical perspectives supporting various positions were found (e.g. Hayward 2003; Gromada 1991).

The presumed benefits of co-bedding are based upon the argument that twins have the capacity to support one another via co-regulation because of their common intrauterine experiences (Nyqvist and Lutes, 1998); "Twins can be more self-sustaining and self-contained because of their twin partner" (Rothbart 1994 quoted in DellaPorta et al 1998). Published observations of co-bedded pre-term twins describe neonates moving close together, touching, holding, hugging, rooting on and sucking one another, and cite synchronous wakeful periods and reduced need for ambient temperature support as benefits of this care-strategy (Nyqvist and Lutes 1998, Lutes

1996, Bingham 1997). Such co-regulatory effects of twin infants upon one another might be expected given the synchronous behaviour and physiological patterns identified between foetuses in twin gestations (e.g. Gallagher et al. 1992). Recent studies of the sleep patterns of preterm infants reported no adverse events for infants in co-bedded arrangements, and that infants exhibited a significant reduction in central apnoea events compared to the period prior to co-bedding (Touch et al 2002). Concerns surrounding co-bedding of term twin infants reflect some of the issues raised in SIDS reduction guidelines, such as suffocation and overheating (DoH 2004).

Publications concerning the benefits of co-bedding for pre-term twins have sparked interest in the issue of twin infant sleeping arrangements generally, but as yet no data have been published regarding the effects of sleeping arrangement on the behaviour or physiology of healthy term twin infants, and health professionals have no clear evidence on which to base advice for parents. Both hospital and community midwives have the opportunity to influence parent's decisions regarding sleeping arrangements in the initial weeks of their infants' lives (Ball 2006) and may be asked by parents about the pros and cons of co-bedding; midwives may therefore need to be familiar with the implications of these arrangements in the post-neonatal period. This study aimed to examine alleged pros and cons of co-bedded and separate sleeping arrangements for healthy term-delivered twins, and to ascertain whether objectively-measured pros and cons for separate and together sleeping arrangements could be identified with regard to disturbance, overheating, compression, synchrony and ease-of-care.

Methods

The study, conducted between December 2001 and December 2002, involved two phases:

1. video monitoring of the sleep behaviour of normally co-bedded infants in their home environment;
2. behavioural and physiological monitoring of twin infants sleeping together and apart in a sleep lab environment.

The first phase of the study was descriptive, designed to obtain data on the normal behaviour of co-bedded twin infants in their home environment. The second phase was experimental, involving the behavioural and physiological monitoring of twin dyads sleeping together and apart in the Durham University Parent-Infant Sleep Lab. Prior to commencing recruitment of participants we sought and received approval from local and multi-regional NHS ethics committees for both phases of the study.

A convenience sample of families with twin infants was recruited via the Twin and Multiple Birth Association (Tamba), local newspapers, posters in hospital wards, and local midwives. Inclusion criteria specified healthy infants of normal gestation, between two and three months of age, located within travelling distance of the Sleep Lab, and with parents willing to a) allow us to video their twin infants in their home for phase-one; and/or b) visit the Sleep Lab with their infants for behavioural and physiological monitoring for phase-two. Eligible volunteers received Participant Information documents and discussed the study with a researcher. Parents willing to participate signed a consent form and completed a set of nightly sleep logs for their babies over a 1 week period. Background demographic data and information regarding night-time infant care practices and normal sleeping arrangements were collected via telephone or face-to-face interview.

Part-one: In-home study

Research staff visited the families' homes and installed video equipment at the infants' normal sleep location. The equipment comprised a small video camcorder connected to a long play video-recorder housed in an attaché case. The camera was mounted on a 2 metre tripod and positioned directly over the infants' cot/Moses basket to obtain a 'bird's eye' view. The camcorder's 'night-shot' facility permitted filming in complete darkness. A continuous date and time signal was overlaid onto the videotape. Parents were asked to care for their infants as normal, provided with instructions to begin recording (using a remote control) once their infants were placed in the cot for the night, and asked to allow the tape to record unimpeded until the infants were removed from the cot in the morning, or the 8-hour tape elapsed, whichever was sooner. Parents were shown how to use the remote control to halt the recording at any point if they felt it was necessary. Babies were filmed for two consecutive nights, the 1st serving as a habituation night (to minimise the effect of the camera on behaviour) and the 2nd night being the monitoring night from which data were analysed (Agnew et al 1966). Following filming researchers returned to the home to dismantle the equipment and conduct a debriefing interview. Parents were offered the opportunity to watch both tapes before giving final consent for them to be used in the study.

Part-two: Sleep-lab trial

Part-two involved a two-condition trial, using infants as their own controls, in co-bedded and separate sleeping configurations. Parents and infants attended the Sleep Lab for 3 nights; on the first (habituation) night babies slept in their normal configuration (Agnew et al 1966); on the two test nights babies slept together or apart in identical standard-sized cots with identical bedding, and controlled room temperature. Test night order was determined randomly via a coin toss performed in the parents' presence. When sleeping apart the infants' cots were positioned side-by-

side with walking space between them for parental access. When parents had prepared their infants to be dressed in their nightclothes a researcher attached physiological monitors to both infants (toe-wrap pulse oximeter, thoracic and abdominal respi-bands, and a flexible rectal thermometer probe). The monitor wires, secured into a single bundle, connected to data-boxes positioned next to each cot. Quick release cables from the data-boxes facilitated movement of the infants from the cot(s). Behavioural monitoring utilised a ceiling-mounted camera and infra-red lighting positioned over the infants' cot(s). The direction and zoom of the camera was manipulated remotely from the adjacent monitoring room and the live camera feed was displayed on-screen. Physiological signals from the data-boxes were downloaded to Winvisi® software in the monitoring room and overlaid onto the video image. Both images and signals were recorded to videotape. Once infants were positioned in their designated sleep location the video and physiological monitoring recordings commenced. Continuous 8-hour recordings were made for each night with a researcher remaining in the monitoring room to ensure the integrity of the data recorded (re-attach probes etc), and to intervene should a potentially risky situation occur. Prior to the start of the study an intervention policy for researchers conducting overnight monitoring was agreed with a local consultant paediatrician. Parents slept in the same room as the infants, but were off camera unless they approached the cot(s). In the morning physiological monitors were removed from the babies by the parents who also participated in a de-briefing interview concerning the preceding night.

Gratuity

A gratuity of £10 per night of monitoring was given to each family (in the form of gift-vouchers) upon completion of each part of the study. Some parents who travelled long distances to bring their infants to the sleep lab requested travel expenses instead of gift-vouchers and these requests were honoured.

Behavioural data

Video-observations were coded to spreadsheets using a purpose-designed behavioural taxonomy (available from the author). Modified duration scores for state behaviours and locations were calculated from scan samples every 3 minutes. Event behaviours were recorded continuously and absolute frequencies and rates computed. Presence/absence data for movement by each infant were recorded using 30 second intervals across the entire night. In part-one sleep states were assigned using behavioural assessment only. Inter and intra-observer reliability scores (kappa coefficients) were calculated to ensure data-integrity. Descriptive and comparative analyses of the behavioural data were conducted using SPSS® (Statistical Package for the Social Sciences) software.

Physiological data

In part-two physiological data were downloaded from Winvisi® to spreadsheets and aligned with behavioural data. Temperature and oxygen saturation was averaged over 1-minute blocks. Respiration traces were used in conjunction with behavioural assessment to determine infants' predominant sleep state for each of the 3-minute blocks.

Results

Part-one: In-home study

Nine pairs of DZ twins, and one pair of MZ twins, were behaviourally monitored sleeping together at home. Four DZ pairs slept head-to-head, while 5 DZ pairs and the MZ pair slept side by side. The parents who participated in part-one had a household income of twice the national average for 2001, were well educated, and in their early thirties (Table 1). Infants were born at 35-weeks gestation or later, and were 6 to 14 weeks old at the time of study.

Table 1: Sample characteristics for phase one and two

Infant Characteristics	**In-home Study**	**Sleep Lab Trial**
No. twin pairs	10	14
Mean infant age	9.72 wks (68 days)	10.71 wks (75 days)
Mean gestation	37.3 wks (261 days)	36.8 weeks (258 days)*
Zygosity	9DZ: 1MZ	12DZ: 2MZ
Mean birth weight	2.56kg	2.61kg
Feeding method	3 mixed	5 mixed
	6 formula	8 formula
	1 breastmilk	1 breastmilk
Parent Characteristics		
Mean maternal age	33	33
Mean paternal age	35	36
Marital status	100% married/cohabiting	100% married/cohabiting
Parity	2.5	3.07
Home ownership	100% homeowners	100% homeowners
Mean age mother left education	20.2 years	19.7 years
Mean age father left education	20.1 years	19.6 years
Mean total income**	£37,920	£38,000

*We did not, as a rule, recruit twin infants who were born extremely prematurely (pre-35 weeks gestation), however due to the importance of obtaining data on MZ twins we included one MZ twin pair born at 32 weeks gestation.

**The average household income for a couple with children in UK in 2001 was £18,876 (ESRC 2005)

The two co-bedding configurations (side-by-side and head-to-head) are described and compared. The mean simultaneous sleep duration (SSD), mean waking

frequency, and mean percentage of night in REM and quiet sleep for all twin pairs, and by sleep configuration are shown in Table 2. There were no significant differences observed between the two co-bedding configurations for any of these measures, however due to the small sample sizes 95% confidence intervals were relatively large.

Table 2: Sleep behaviour of co-bedded infants at home

	All twin pairs (n=10)	Head-to-Head (n=4)	Side-by-side (n=6)
Simultaneous sleep duration (mins)	380.40	401.25	366.50
(95% confidence interval)	(+/-43.47)	(+/-74.85)	(+/-55.26)
Wake frequency	3.50	3.75	3.33
(95% confidence interval)	(+/-1.17)	(+/-2.06)	(+/-1.49)
% duration REM sleep	57.2%	52.3%	60.6%
(95% confidence interval)	(+/-7.87)	(+/-4.05)	(+/-12.56)
% duration Quiet sleep	29.6%	34.9%	26.0%
(95% confidence interval)	(+/-7.45)	(+/-10.29)	(+/-10.64)

All infants slept in a supine position for the whole of the observation night, regardless of co-bedded configuration. Infants co-bedded side-by-side spent more time oriented towards one another than facing away from their co-twin (mean duration towards twin = 65.4% of night, mean duration away = 27% of night). Infants positioned head-to-head were unable to face one another. Co-bedded infants in both

configurations spent two-thirds to three-quarters of the night touching one another, with no significant difference in the percentage duration in contact.

We examined the duration of head-covering by bed-covers, and airway covering by bed-covers and co-twin's body. No head-covering occurred for any of the twin pairs. Airway covering was observed occasionally, resulting either from swaddling, or (in the case of side-by-side co-bedding) one infant's arm resting across the co-twin's face. Infants positioned side-by-side experienced airway covering for a mean duration of 3.57% of the night (14.3 minutes), while head-to-head infants experienced airway covering for a mean duration of 1.44% of the night (5.5 minutes). The difference between the two configurations was not significant, with overlapping 95% confidence intervals. None of the side-by-side infants were physically compressed or 'rolled-on' by a co-twin. The results of the in-home observational study identified no aspects of infant sleep behaviour that differed significantly between the two co-bedding configurations. We therefore were able to eliminate co-bedding configuration as a variable from the sleep lab trial.

Sleep-lab trial

Twelve pairs of DZ and 2 pairs of MZ twin infants under the age of 3 months were behaviourally and physiologically monitored over a 3 night period. Parents were recruited to this portion of the study via local advertising (7 families) and through Tamba (7 families). Sample characteristics are summarised in Table 1. Eight of the twin pairs normally slept together (same cot) at home (designated as routinely together) while six slept in separate cots or Moses baskets (designated as routinely separate). All of those sleeping in Moses baskets did so in their parents' room, as did all but one of the pairs who shared a cot. The results from part-two compare infant behaviour, physiology and sleep characteristics for twins sleeping together and apart and test *a priori* hypotheses generated by parental interviews in a previous study (Ball

2006). Twin pairs served as their own controls in this 2-condition trial. The test nights are designated 'separate night' and 'together night'. No situation observed on any test night met the pre-defined criteria for intervention therefore infants were simply monitored throughout.

Sleeping and waking

Sleep duration was compared on together nights and separate nights for all infants, and partitioned by routine sleep condition (routinely together or routinely separate). No significant differences were found in the overall amount of total, REM or quiet sleep achieved by infants in both the co-bedded and separate sleeping arrangements. Infants spent greater proportions of sleep time in REM when sleeping in their usual condition than in the alternate (Table 3), and both sets of infants obtained more quiet sleep on the separate night; none of these differences was statistically significance, and 95% confidence intervals were similar on both nights and for both routine conditions. There was no significant difference in waking frequency in the two conditions (Table 4).

Table 3: Sleep characteristics of infants on co-bedded (together) and separate nights

	All infants (n=14)	Routinely-separate infants (n=6)	Routinely-together infants (n=8)
Mean % total sleep duration on together-night (95% confidence interval)	77.50 (+/-6.10)	74.07 (+/-11.41)	80.07 (+/-6.53)
Mean % total sleep duration on separate-night (95% confidence interval)	79.49 (+/-6.19)	76.2 (+/-11.86)	81.8 (+/-6.43)
Mean % REM on together-night (95% confidence interval)	45.53 (+/-4.50)	43.0 (+/-9.62)	47.40 (+/-3.41)
Mean % REM on separate-night (95% confidence interval)	44.28 (+/-4.65)	47.09 (+/-5.34)	42.17 (+/-7.02)
Mean % QS on together-night (95% confidence interval)	20.62 (+/-3.69)	20.16 (+/-7.94)	20.96 (+/-3.20)
Mean % QS on separate-night (95% confidence interval)	22.90 (+/-4.36)	21.30 (+/-8.27)	24.10 (+/-4.83)

No significant differences were found between together and separate nights or routinely-separate and routinely-together infants.

Table 4: Waking on co-bedded (together) and separate nights

	Together-night	Separate-night
Mean waking frequency, all infants (n=14)	2.71	2.36
(95% confidence interval)	(+/-0.42)	(+/-0.44)
Mean for routinely-together infants (n=8)	2.64	2.25
(95% confidence interval)	(+/-0.62)	(+/-0.64)
Mean for routinely-separate infants (n=6)	2.80	2.50
(95% confidence interval)	(+/-0.61)	(+/-0.62)

Sleep position

Infants overwhelmingly slept supine on both nights. One pair spent 22.5% and 26% respectively of the separate-night sleeping in a lateral position having been placed in the cot by their parents with a wedge of bedding behind their backs. On the together-night they again had bedding wedged behind their backs, however this time it was unsuccessful. Nevertheless one of these infants self-positioned onto his side for 18% of the night.

Orientation, proximity, and movement

Infants positioned side-by-side spent 47% of the together-night oriented towards their co-twin compared with 29% of separate-night when sleeping side-by-side in separate cots. Routinely-together infants spent 35.3% of the separate-night oriented in the direction of their co-twin compared with 20% for routinely-separate infants – a difference that just reached significance (p=0.045). Routinely-together infants spent a greater proportion of the together-night physically touching one another than did the routinely-separate infants (35% vs 15%), but the wide range of variation for routinely-

together infants (0% to 73%) associated with their arrangement in the cot meant that the difference was not statistically significant and confidence intervals were broad.

The proportion of 30-second epochs in which movement was observed was compared across the two conditions. Infants moved, on average, during 31% of epochs on the together-night and 30% on the separate-night. Movement by both infants occurred during a mean of 13% of epochs on together-night and 10% on the separate-night. There were no significant differences found between test-night sleep conditions. Movements predominantly involved limb and head movement. In 56 baby-nights of observation only 1 infant independently altered their location – from foot to middle of the cot on the separate-night.

Temperature

One twin-pair received immunisations on the day preceding a sleep lab night, and their temperature data were therefore excluded from analysis due to artificial elevation. We found no difference in the core temperature of infants on the together-night and separate-night (Table 5). The mean peak difference between the two conditions was 0.015^{o}C; the mean difference in nadir was -0.015^{o}C. Temperature trajectory across the night was plotted graphically for all infants and none of the twin pairs exhibited temperature synchrony, regardless of condition or degree of contact.

Table 5: Core temperature extremes on test nights (n=14)

	Together-night	Separate-night
Mean Peak	37.33 °C	37.28 °C
(95% confidence interval)	(+/-0.13)	(+/-0.09)
Mean Nadir	36.47 °C	36.46 °C
(95% confidence interval)	(+/-0.17)	(+/-0.10)

Compression, airway covering and head covering

Overlaying or body compression of one twin by another was not observed. In two cases one twin rested a limb (arm) across the co-twin's face on the together-night. These incidents occurred when babies were located side-by-side in close proximity. Neither incident lasted longer than 10 minutes, nor was an infant's mouth or nose completely obstructed. One instance was associated with slightly lowered oxygen saturation (but not lowered sufficiently to the point where intervention was required), followed by arousal and movement by the affected infant.

Face covering by bedding occurred for one pair only, and occurred in both test conditions as a result of swaddling. On the together-night the infants' external airways were entirely covered for 70% and 74% of the night respectively compared with 50% and 91% on the separate-night (Figure 1).

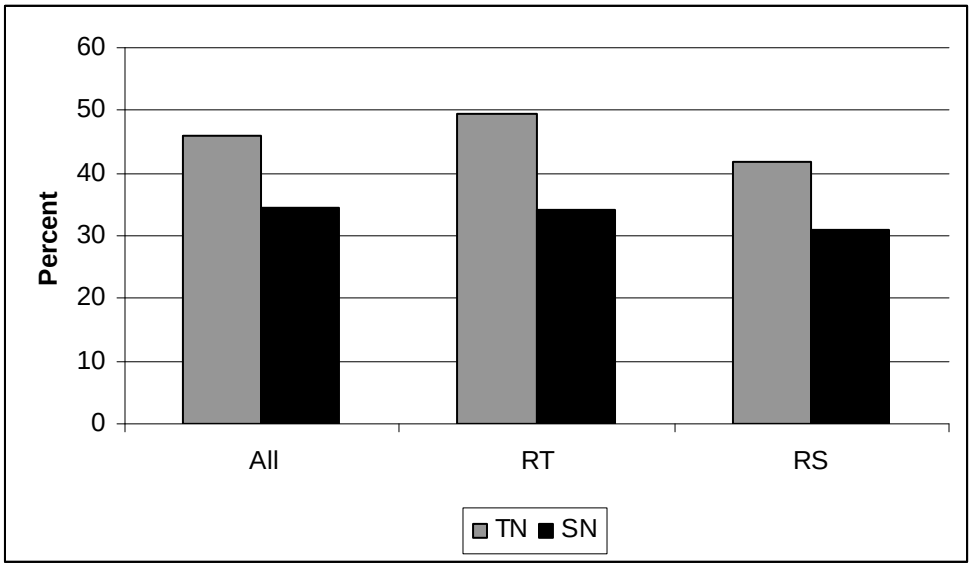
Figure 1: Swaddling covering infants' airways on together (co-bedded) night

The infant who spent 91% of the separate-night with airways covered was the only baby observed to experience whole head covering (15.6% of SN) -- a consequence of his struggle to free himself from the blankets that covered his mouth and nose when swaddled. A 30 minute portion of REM sleep with the whole head covered was compared to a previous 30 minute portion of REM sleep with the head uncovered. The mean core temperature for the head-covered period was 36.94°C compared to 36.5°C when uncovered (Wilcoxon, z=-2.677, p=0.007).

Sleep and feeding synchrony

Overall sleep state (awake, REM, quiet and indeterminate) was synchronised for a significantly greater proportion of together-nights (46.0%) than separate-nights (34.6%) as shown in Figure 2. Partitioning by routine condition revealed that although routinely-separate infants demonstrated greater synchrony on the together-night than the separate-night, it was only for routinely-together infants that sleep synchrony was significantly greater (Figure 2). No difference was found in the synchrony of feeding bouts on the two test nights.

Figure 2: Sleep synchrony



All infants on together-night (TN) vs separate-night (SN), p=0.017; Routinely-together (RT) infants on TN vs SN, p=0.034. No other differences were significant. RS=Routinely-separate infants.

Discussion

In a previous report on the night-time care of newborn twins we described parents' reasons for sleeping their twin infants together or apart (Ball 2006). This subsequent study provides empirical data with which to evaluate these beliefs and assumptions. Explanations for sleeping twins separately involved: 1) infants sharing a cot disturb one another; 2) infants sharing a cot may overheat; 3) infants sharing a cot may suffocate one another. Explanations for sleeping twins together involved: 4) infants sharing a cot sleep better; 5) infants sharing a cot exhibit synchronised sleep patterns; 6) infants prefer to share a cot; 7) infants sharing a cot are easier to care for. These assertions are evaluated below in light of the data reported here.

We compared infants' at-home sleep behaviour in side-by-side and head-to-head sleeping arrangements and discovered no differences: infants slept for equivalent durations, and exhibiting similar proportions of visually determined REM and quiet

sleep in both configurations. We found no evidence that either side-by-side or head-to-head co-bedding was associated with potential suffocation or compression. Short periods of partial airway covering resulted both from swaddling, and from the limb of one twin impinging on the nose or mouth of the other. No complete airway covering was observed and no infants struggled to breathe or free themselves, however all infants in the study were of similar size and body-weight. The issue of compression by a co-twin could be of greater concern should there be a mismatch in size between the infants.

In the sleep lab trial none of the suggested reasons against co-bedding were supported by the data, however we found some evidence to support reasons that favoured co-bedding. We found no support for reasons 1 or 4 with no difference in the duration of overall sleep, waking frequency, or the duration of sleep components, for the infants in the two conditions. Furthermore the observation of several infants remaining asleep next to a screaming co-twin further refutes explanation 1 and suggests habituation. Co-bedded twins did exhibit synchronous sleep states (explanation 5) with a significantly greater proportion of the night spent in synchronous states when co-bedded than when apart. For the twins who normally shared a cot this effect was particularly pronounced, with evidence that they lost their synchronous patterning on the night they slept separately. For the normally solitary sleeping twins the co-bedded night resulted in an increase in synchrony, but not to the point of statistical significance. This reinforces the notion that the synchrony observed *in utero* (Gallagher e al., 1992; Sherer et al 1990) and in premature twins (e.g. Hayward 2003) persists into infancy if close proximity is maintained. The orientation bias observed among normally co-bedded twins, even when sleeping apart, suggests that babies who normally sleep together are attuned to one another's presence in a way that is not exhibited by separately sleeping infants. This preferential orientation, plus the high proportion of the night that some co-bedded

pairs spent in close physical contact, combined with the reduction in synchrony when separated, may explain parents' perceptions that their infants prefer sleeping together (explanation 6), and that co-bedded infants are easier to care for. Our previous finding that co-bedded infants are more likely to remain in their parents' room for longer also supports ease of care, particularly for breastfeeding mothers (Ball 2006).

No support was found for the suggestion that healthy co-bedded twins may overheat when sleeping in close proximity; infant core temperatures showed no difference in maximum peak or minimum post-sleep fall in the two sleep conditions. The issue of whether heat loss may be compromised in a situation where one or both infants are experiencing pyrexia and are co-bedded remains to be investigated. As with the in-home study, the sleep lab trial found no evidence in support of co-twin compression or potential asphyxia during co-bedded nights. Despite the fact that on occasion one twin's limb rested across a sibling's face this resulted in only a minor fall in oxygen saturation of the affected infant who was able to free himself easily. The use of swaddling in both the in-home and lab-trial phases of this study was found to be associated with airway covering, and in one instance with head covering that resulted in increased core temperature (although the increase did not rise above normal body temperature). The issue of infant swaddling is not intrinsically related to the issue of sleeping arrangements for infant twins, and was a minority practice both in the home and the lab. As there was some suggestion in previous research that parents may be using swaddling as a means to restrain co-bedded infants to prevent disturbance (Ball 2006), and as disturbance by a co-twin has been found here to be minor, there is little argument to support swaddling in this situation.

It should be remembered that this was a small-scale study, and the 95% confidence intervals are relatively broad. Lack of differences between the co-bedded and

separate sleep conditions for twin infants found in this study should therefore be regarded as suggestive, not conclusive. We hope this initial research will stimulate larger studies into the issues of twin infant sleeping arrangements.

Conclusions

In this relatively small study, the co-bedding of term twin infants less than 3 months of age does not appear to be associated with the negative attributes that concern some parents. Co-bedded infants neither woke more frequently, nor slept for longer, than those sleeping separately, but experienced greater sleep state synchrony. Routinely co-bedded infants exhibited the most synchronisation. Co-bedded infants sleeping in close bodily contact with one another did not exhibit increased core temperature. Swaddling of co-bedded infants may be problematic due to covering of external airways, but this is not a problem specific to co-bedding of twins unless parents are using swaddling as a means to restrain their babies' arms in a co-bedded scenario. Equivalently sized twins did not compress one another, or cause effective obstruction of one another's airways. Until further data are available caution should be used in co-bedding infants experiencing pyrexia. This study provides the first indicative evidence for the use of health care staff in providing parents with evidence-based information about term twin infant sleeping arrangements, and in formulating policies and advice. We hope this initial study stimulates further research on a larger scale.

References

Agnew, H. W., V. B. Webb, et al. (1966). "The first night effect: an EEG study of sleep." Psychophysiology 2 (3): 263-266.

Ball HL. (2006) Caring for twin infants: sleeping arrangements and their implications Evidence Based Midwifery 4(1):xx-xx.

Beck CT. (2002) Releasing the pause button: mothering twins during the first year of life. Qualitative Health Research 12(5): 593-608.

Bingham R. (1997) Let's spend the night together. Neonatal Network: Journal of Neonatal Nursing 16 (2), 54-55.

Bowers N. (1998) The multiple birth explosion: Implications for nursing practice. Journal of Obstetric, Gynecologic, and Neonatal Nursing 27: 302-310.

Chang C. (1990) Raising twin babies and problems in the family. Acta Genetica Medica Gemellolgica 39: 501-505.

DellaPorta K. Aforismo D. Butler-O'Hara M. (1998) Co-bedding of twins in the neonatal intensive care unit. Pediatric Nursing 24(6): 529-531.

ESRC [Economic and Social Research Council] (2005) "Personal finances in the UK" ESRC factsheet, http://www.esrcsocietytoday.ac.uk/ESRCInfoCentre/facts/UK/ posted 15.02.2005

Gallagher MW. Costigan K. Johnson TR. (1992) Fetal heart rate accelerations, fetal movement, and fetal behavior patterns in twin gestations. American Journal of Obstetrics and Gynecology 167 (4) 1140-1144.

Gromada KK. (1991) Mothering multiples. La Leche League International, Illinois.

Hayward K. (2003) Cobedding of twins: a natural extension of the socialization process. MCN: The American Journal of Maternal Child Nursing 28(4): 260-263.

Holditch-Davis D. Roberts D. Sandelowski M. (1999) Early parental interactions with, and perceptions of, multiple birth infants. Journal of Advanced Nursing 30(1): 200-210.

Lutes L. Vandenberg KA. (1996) Bedding twins/multiples together. Neonatal Network: Journal of Neonatal Nursing 15 (7): 61-62.

Multiple Births Foundation (2005) Multiple Births Foundation Website: General information. Accessed 19.9.05. www.multiplebirths.org.uk/media.asp

Nyqvist KH. Lutes LM. (1998) Co-bedding twins: a developmentally supportive care strategy. Journal of Obstetrical, Gynaecological and Neonatal Nursing 27 (4), 450-456.

Sherer DM. Nelson LE. Hadeed A. Anderson LC. (1990) The occurrence of simultaneous fetal heart rate accelerations in twins during nonstress testing. Obstetrics and Gynecology 76(5): 817-821.

Touch SM. Epstein ML. Pohl CA. Greenspan JS. (2002) The impact of cobedding on sleep patterns in preterm twins. Clinical Pediatrics 41:425-31.

Yokoyama Y. (2002) Childcare problems in mothers with twins as compared with children born singly. Nippon Koshu Eisei Zasshi Mar 49: 229-35 (English abstract only).